Effective Human-Robot Collaborative Work for Critical Missions

Completed Technology Project (2012 - 2015)

Project Introduction

The objective of this project is to improve human-robot interaction (HRI) in order to enhance the capability of NASA critical missions. This research will focus two top challenges identified by the NASA RTA panel: improving the understanding and expressing of intent between humans and robots and creating supervised autonomous HRI loops. To address these challenges, this proposal will explore the design space of inferring human intent and cognitive state and the design space of improving robot feedback. This proposal will utilize cutting-edge brain-computer interface (BCI) technology to aid robots in inferring user intent and cognitive state. Recent improvements in BCI allow for the continuous passive monitoring of human features such as attention and cognitive load via low-cost wireless headsets with no need for extra training. Robots armed with such knowledge will improve collaborative control by knowing when it is best to interrupt their human partners to request aid and gaining further contextual task-based knowledge. This information will be combined with other robotic sensors to increase robot understanding of human intent. This research will also work towards improving the communication channel whereby robots convey information back to human partners. To this end, this research will leverage advances in social and cognitive psychology to imbue robots with the knowledge of and ability to use social cues. These cues, such as gestures and eye gaze, will enhance human-robot collaborative work regardless of task domain by creating more fluid and effective interactions. Overall, this research will make practical and appreciable gains to NASA's robotic systems by creating closed-loop, intuitive, minimal error human-robot interactions.

Anticipated Benefits

This research will also work towards improving the communication channel whereby robots convey information back to human partners. To this end, this research will leverage advances in social and cognitive psychology to imbue robots with the knowledge of and ability to use social cues. These cues, such as gestures and eye gaze, will enhance human-robot collaborative work regardless of task domain by creating more fluid and effective interactions. Overall, this research will make practical and appreciable gains to NASA's robotic systems by creating closed-loop, intuitive, minimal error human-robot interactions.

Project Image Effective Human-Robot Collaborative Work for Critical Missions

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Responsible Program:

Space Technology Research Grants

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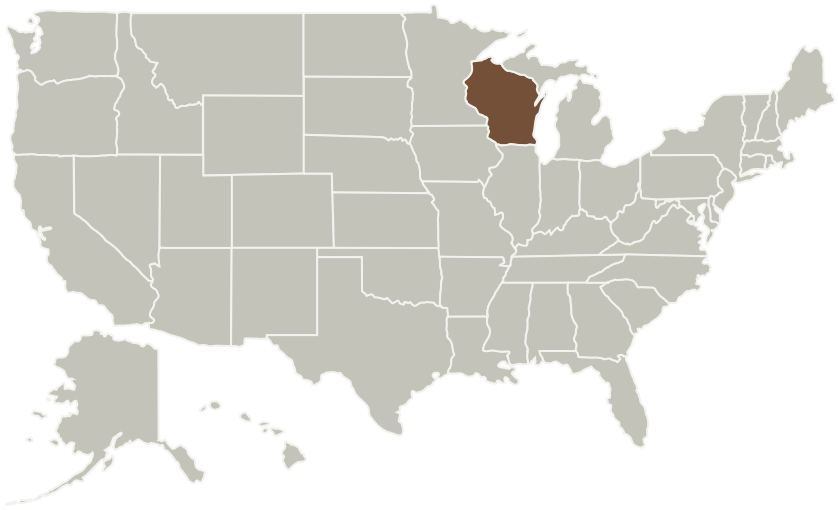
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
University of Wisconsin-Madison	Supporting Organization	Academia	Madison, Wisconsin

Primary U.S. Work Locations
Wisconsin

Project Management

Program Director:
Claudia M Meyer

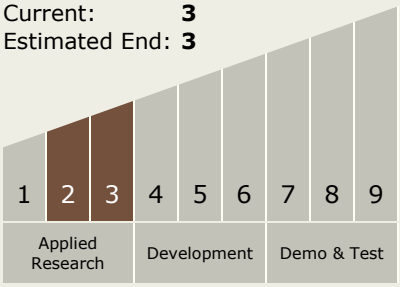
Program Manager:
Hung D Nguyen

Principal Investigator:
Bilge Mutlu

Co-Investigator:
Daniel Szafir

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.4 Human-Robot Interaction
    - TX04.4.1 Multi-Modal and Proximate Interaction

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Images

11542-1363183949404.jpg
Project Image Effective Human-Robot Collaborative Work for Critical Missions
(https://techport.nasa.gov/image/1762)

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html